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September 5, 2018

VIA ECFS

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation
ET Docket No. 18-39

Dear Ms. Dortch:

Sensible Medical Innovations Ltd. ("Sensible"), through its counsel, submits this letter to respond to points raised by Philips Healthcare ("Philips") and Globalstar Inc. ("Globalstar") in the above-captioned proceeding, which involves Sensible's request for a limited waiver of the FCC's Part 15 rules governing ultra-wideband ("UWB") medical imaging devices. Sensible seeks these waivers to market a medical device that uses dielectric sensing to provide non-invasive measurement of lung fluid (the "ReDS System").[1] This letter provides the additional information requested by Philips and a technical analysis that demonstrates Globalstar's concerns that ReDS devices may cause harmful interference to its satellite uplink operations are unwarranted.

Philips Healthcare. Philips requests additional technical information to ensure that the ReDS System will not interfere with Smart-Hopping Telemetry Systems.[2] For example, Philips states that Sensible did not identify the 16 frequencies or UWB modulation used by the ReDS System's electromagnetic signal.[3] Philips also states that "[t]he Philips system is designed with agile frequency management" and warns that the ReDS System's UWB signal could "act as a wideband noise source into a nearby Philips Smart-Hopping System."[4] Philips is concerned about having the ReDS System and Smart-Hopping System receiver operating simultaneously on the same patient, and having the ReDS System operating in proximity to a Smart-Hopping Access Point.

[1] Sensible, Request for Waiver, ET Docket No. 18-39 (filed Jan. 16, 2018) ("Waiver Request"); *Office of Engineering and Technology Seeks Comment on Sensible Medical Innovations Ltd's Request for Waiver of Part 15 Ultra-Wideband Rules for Medical Imaging System*, Public Notice, 33 FCC Rcd 1307 (OET 2018).

[2] *See* Reply Comments of Philips Healthcare, ET Docket No. 18-39 (filed Mar. 27, 2018) ("Philips Reply Comments").

[3] *See id*.

[4] *See id*. at 4.

The information requested by Philips follows below. First, ReDS devices emit in 16 frequencies in the 1005-1709 MHz band, as explained in our Reply Comments.[5] The following table details these frequencies:[6]

Table 1: ReDS Frequencies

#	Frequency [MHz]
1	1005.0625
2	1083.0625
3	1164.0625
4	1243.0625
5	1257.0625
6	1303.0625
7	1347.0625
8	1417.0625
9	1427.0625
10	1492.0625
11	1517.0625
12	1611.0625
13	1629.0625
14	1655.0625
15	1657.0625
16	1709.0625

None of the frequencies used by ReDS devices falls within the 1395 to 1400 MHz Wireless Medical Telemetry ("WMTS") band, but the 1427.0625 MHz frequency falls within the 1427 to 1432 MHz[7] WMTS band by 0.0625 megahertz. This is on the very edge of the band and thus likely to be attenuated by filtering. The power budget calculations below suggest that emissions from the ReDS System are highly unlikely to cause telemetry channel switching even without taking any filtering into account.[8]

The ReDS System signal has a dwell time of approximately 4.5 milliseconds at each frequency, introducing a bandwidth of less than 0.25 kHz. Therefore, it does not "act as a wideband

[5] *See* Reply Comments of Sensible Medical Innovations, ET Docket No. 18-39, at 2-3 (filed Mar. 27, 2018) ("Sensible Reply Comments").

[6] Although these are the frequencies used currently, future research may reveal that a different number of frequencies and/or the use of different frequencies may improve performance of the ReDS System.

[7] Philips specifies the upper portion of the primary allocated WMTS band as 1427-1431.5 MHz, but the allocation goes to 1432 MHz. *See id*. at 1; FCC, Wireless Medical Telemetry Service (WMTS), https://www.fcc.gov/wireless/bureau-divisions/broadband-division/wireless-medical-telemetry-service-wmts (last visited Sept. 5, 2018).

[8] *See* Philips Reply Comments at 4.

noise source" and does not impose a risk of blocking multiple channels of a system that employs "agile frequency management," such as the Philips Smart-Hopping System.[9] The measured peak Effective Isotropic Radiated Power ("EIRP") for the ReDS System is -47 dBm.[10]

The ReDS System transmitter synthesizer phase noise is below -100 dBc/Hz at frequencies offset by 1 megahertz or more from the Center Frequency ("CF"). The ReDS System transmitting transducer is placed on the patient's back such that it would be separated by at least 0.25 meters from a Smart-Hopping System telemetry unit, which would be on the front chest or side of the patient. This translates into a free space loss of about 23.5 dB. It follows that the ReDS System's peak signal EIRP at frequency offsets of 1 megahertz or more from the CF would be below -170 dBm/Hz (-47 dBm CF EIRP with -123.5 dBc/Hz). The ReDS System's signal therefore imposes no risk to channels operating at frequencies 1 megahertz or more away.

Philips' Smart-Hopping IntelliVue system specifications state that the technology "dodges interference and locates the strongest available signal wherever the patient roams" and that "[d]ynamic wireless channel allocation ensures best use of available wireless spectrum."[11] The specifications further state that channel spacing used is 1.6 megahertz over the total 10 megahertz WMTS band (split into two 5 megahertz bands).[12] This results in at least 6 non-overlapping channels, of which the ReDS System may at most interfere with a single one due to its narrow bandwidth. This potential interference may result at most in a channel switch, which should not degrade performance. Further, interference would only occur during the operation of the ReDS device, which is operated intermittently several times per day, for 90 seconds each time, with a low duty cycle of 2.1-5.2% per frequency during transmission.

Looking at the channel containing the 1427.0625 MHz signal, Philips states that "[t]he typical[] signal level deployed in Philips Smart-Hopping systems is -68 dBm."[13] By comparison, Sensible tests have shown that peak power in these frequencies is limited to below 47 dBµV/m at a distance of three meters, so it follows that the ReDS device's potential interference power is at most -89.6 dBm at 2 meters for the access point (and -71.6 dBm at 0.25 meters).

This is a worst-case calculation and assumes no receiver filtering or additional losses that would likely occur due to the way that measurements are typically conducted with the ReDS System. For example, it should be noted that the ReDS System's emitting sensor is placed on the back of the patient and is pressed against the patient, who reclines back in a sitting or lying position in a bed. ECG leads or SpO_2 sensors using the Smart-Hopping Telemetry System are typically on the front chest or side of the patient. This will introduce additional non-line-of-sight ("NLOS") attenuation that will eliminate the need for Smart-Hopping channel switches even when both systems are operating on the same patient.

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[9] *Id*.

[10] This measurement reflects the worst case. *See* Sensible Reply Comments at 4-5 (showing the EIRP for two other frequencies to be -48.2 dBm (1164.063 MHz) and -47.2 dBm (1611.00 MHz)).

[11] Philips, M4840A/M4841A Technical Data Sheet, http://www.usmed-equip.com/content/datesheet/pdfs/Philips_M4841A_Datasheet.pdf (last visited July 3, 2018).

[12] *See id*.

[13] Philips Reply Comments at 4.

It should also be emphasized that the ReDS System's EIRP is at least 27 dB below any of the *unintentional* emission limits for this band and that the ReDS System operates with an extremely low duty cycle.[14]

In sum, the ReDS System will not cause harmful interference and should not introduce challenges to Smart-Hopping Telemetry Systems due to its extremely narrow signal (around each center frequency), low power, and low duty cycle. Indeed, the ReDS System would not impose a risk to the integrity and continuity of the Philips telemetry system, even in worst case conditions. In addition, Sensible is willing to restrict its signal to frequencies that do not overlap with either the 1395-1400 MHz band or the 1427-1432 MHz band, except for the currently used frequency of 1427.0625 MHz.

Globalstar, Inc. Globalstar is concerned that ReDS devices could cause harmful interference to its Mobile Satellite Services (MSS) uplink operations in the 1.6 GHz satellite band (Earth-to-space).[15] These concerns are unwarranted. As shown below, the signal received by Globalstar's satellite receivers will be approximately 28 dB below the noise floor of a 1 kilohertz received signal. ReDS devices would be operated indoors and with extremely low power, whereas Globalstar's satellite receivers are 400 kilometers above the Earth.

Table 2: Globalstar MSS Uplinks

Parameter	Value	Units
K	1.38E-23	[W/KH]
T	298	[k]
B	1000	[Hz]
KTB	4.11E-18	[W]
Antenna Noise dBm	-143.86	[dBm]
Peak Power	47.00	[dBµV/m] @ 3m
Peak Power [EIRP]	-48.20	[dBm]
Distance	400000.00	[m]
Frequency	1611.00	[MHz]
Wall Attenuation	15.00	[dB]
Free Space Loss	148.62	[dB]
Spreading Gain	0.00	[dB]
Satellite Antenna Gain	40.00	[dBi]
Total Attenuation	163.62	[dB]
Equivalent Received Power	-171.82	[dBm]
Margin From Thermal	-27.96	[dB]

[14] *See* 47 C.F.R. § 15.109.

[15] Reply Comments of Globalstar, Inc., ET Docket No. 18-39 (filed Mar. 27, 2018).

Pursuant to Section 1.1206(b) of the Commission's rules, I am submitting this notice electronically in the above-referenced docket. Please contact me directly with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar

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